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PART II

DEPARTMENT OF LABOR

OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION

■

Power Transmission and Distribution Lines; Use of Helicopters; Aerial Lifts; Sanitation Facilities for Mobile Crews

Notice of Proposed Rule Making

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[29 CFR Parts 1910, 1926]

[Docket No. R-1]

POWER TRANSMISSION AND DISTRIBUTION LINES; USE OF HELICOPTERS; AERIAL LIFTS; SANITATION FACILITIES FOR MOBILE CREWS

Notice of Proposed Rule Making

The Advisory Committee on Construction Safety and Health has recommended the promulgation of regulations for power transmission and distribution lines and equipment.

The Advisory Committee has also recommended the promulgation of standards for aerial lifts and standards covering the use of helicopters and provision of sanitation facilities for mobile crews.

Upon consideration of the recommendations of the Advisory Committee, and pursuant to authority in section 6(b) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593), section 107 of the Contract Work Hours and Safety Standards Act, as amended (83 Stat. 96), and in 29 CFR Part 1911 (36 F.R. 17506), I hereby propose to amend Parts 1926 and 1910 of Title 29, Code of Federal Regulations, as set forth below.

Interested persons are invited to submit data, views, and arguments concerning the proposed standards, both orally and in writing.

Submissions of written data, views, and arguments shall be in quadruplicate, and shall be mailed to Chief Hearing Examiner H. Stephen Gordon, at Room 720, Vanguard Building, 1111 20th Street NW., Washington, DC 20036 within 30 days after the publication of this notice in the FEDERAL REGISTER. The data, views, and arguments will be available for public inspection and copying at the Chief Hearing Examiner's office, except as to matters the disclosure of which is prohibited by law.

Oral data, views, and arguments concerning the proposed standards will be received by Hearing Examiner Arthur M. Goldberg at a hearing beginning at 10 a.m. on June 27, 1972, in Conference Room B, Departmental Auditorium, U.S. Department of Labor, 14th Street and Constitution Avenue NW., Washington, D.C. Persons desiring to appear at the hearing must file with the Chief Hearing Examiner a notice of intention to appear, no later than 30 days after the publication of this notice in the FEDERAL REGISTER. The notice must state the name and address of the person to appear, and the approximate amount of time required for his presentation. The notice must also include, or be accompanied by, a statement of the position to be taken with regard to each specified proposal, and of the evidence to be adduced in support of the position.

Beginning at 9:30 a.m. on June 27, 1972, the Hearing Examiner will hold a brief prehearing conference in order to establish the order and time for the presentation of statements and settle other matters which may be relevant to the proceeding. Also at the prehearing conference there will be an exchange of copies of any prepared statements that are intended to be made a part of the record. All documents intended to be submitted for the record at the hearing should be submitted in duplicate.

The hearing shall be conducted in accordance with the rules of procedure in 29 CFR Part 1911.

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

A. Proposed amendments to Part 1910 of Title 29, Code of Federal Regulations:

1. Section 1910.12 is hereby proposed to be amended by adding thereto a new paragraph (d). As amended, § 1910.12 would read as follows:

§ 1910.12 Construction work.

* * * * *

(d) For the purposes of this part, to the extent that it may not already be included in paragraph (b) of this section, construction work includes the erection of new electric transmission and distribution lines and equipment, or the alteration, conversion, or improvement of existing transmission and distribution lines and equipment.

PART 1926—SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

B. Proposed Amendments to Part 1926 of Title 29, Code of Federal Regulations:

1. Section 1926.51 is proposed to be amended by adding thereto a new paragraph (c)(4). As amended, § 1926.51 would read as follows:

§ 1926.51 Sanitation.

* * * * *

(c) * * *

(4) These requirements for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby sanitation facilities.

* * * * *

2. Section 1926.400 is proposed to be amended by revising paragraph (a) thereof. As amended § 1926.400 would read as follows:

§ 1926.400 General requirements.

(a) All electrical work, installation, and wire capacities shall be in accordance with pertinent provisions of the National Electrical Code, NFPA 70-1971; ANSI C1-1971 (Rev. of 1968), unless otherwise provided by regulations of this part.

* * * * *

3. Section 1926.451 is proposed to be amended by revising paragraph (f) thereof. As amended § 1926.451 would read as follows:

§ 1926.451 Scaffolding.

* * * * *

(f) *Elevating and rotating work platforms.* Applicable requirements of American National Standards Institute A92.2-1969, Vehicle Mounted Elevating and Rotating Work Platforms, shall be complied with for such equipment, as required by the provisions of § 1926.556.

* * * * *

4. Section 1926.551 is proposed to be amended by revising paragraphs (a) and (b) and adding thereto new paragraphs (c) through (s). As amended, § 1926.551 would read as follows:

§ 1926.551 Helicopters.

(a) *Helicopter regulations.* Helicopter cranes when used shall conform to all applicable regulations of the F.A.A., 14 CFR Part 133, Rotorcraft External-Load Operation adopted January 17, 1964, effective May 17, 1964 or 14 CFR 91.39 Restricted Category Civil Aircraft, Operating Limitation adopted June 24, 1963, effective September 30, 1963.

(b) *Pilot licensing.* Rotorcraft pilots shall be licensed to conduct external load operations in accordance with 14 CFR Part 133 Rotorcraft External-Load Operation adopted January 17, 1964, effective May 17, 1964, or 14 CFR 91.39 Restricted Category Civil Aircraft, Operating Limitation adopted June 24, 1963, effective September 30, 1963.

(c) *Briefing.* The employer shall brief all employees participating in the external load helicopter operations as to their duties prior to each day's operation.

(d) *Slings and tag lines.* Load shall be properly slung. Tag lines shall be of a length that will not permit their being drawn up into rotors.

(e) *Cargo hooks.* All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation. In addition these cargo hooks shall be equipped with an emergency mechanical control for releasing the load. The hooks shall be tested prior to each day's operation to determine that the release functions properly (both electrically and mechanically).

(f) *Personal protective equipment.* (1) Personal protective equipment for employees receiving the load shall consist of complete eye protection and hard hats secured by chinstraps.

(2) Loose fitting clothing likely to flap in the down wash and thus be snagged on hoist line, shall not be worn.

(g) *Loose gear.* All loose gear within 100 feet of the place of lifting or placing of the load shall be secured or removed. Good housekeeping in these areas shall be maintained at all times. Every precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash.

(h) *Operator responsibility.* The helicopter operator shall be responsible for size, weight, and manner in which loads are connected to the helicopter. If, for any reason, the helicopter operator feels the lift cannot be made safely, the lift shall not be made.

(i) *Emergency landing area.* The provisions of F.A.A., 14 CFR 135.89, shall be complied with.

(j) *Hooking up loads.* When hooking up loads to hovering craft, a safe means of access shall be provided for employees to reach hoist and engage cargo slings.

(k) *Static charge.* Static charge on rotorcraft shall be dissipated with a grounding device before ground personnel touch the suspended load.

(l) *Weight limitation.* The weight of an external load shall not exceed the manufacturer's rating.

(m) *Ground lines.* Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel from a helicopter, shall not be attached to any fixed ground structure, or allowed to foul on any fixed structure.

(n) *Visibility.* When visibility is reduced by dust or other conditions, ground personnel shall exercise special caution to keep clear of main and stabilizing rotors.

(o) *Signal system.* Signal systems between aircrew and ground personnel shall be understood and checked in advance of hoisting load. This applies to either radio or hand signal systems. Hand signals shall be as shown in Figure N-1.

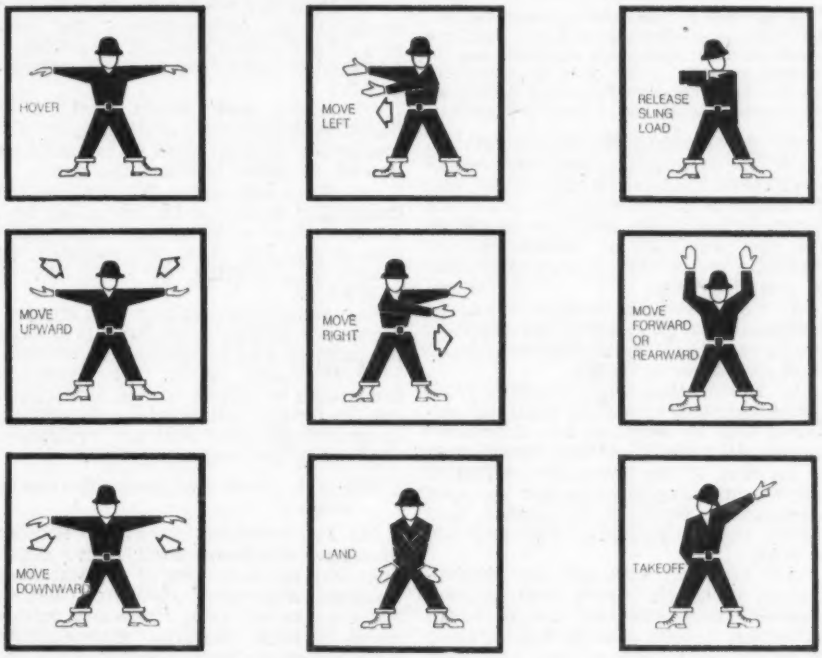

Figure N-1

(p) *Approach distance.* No unauthorized person shall approach within 50 feet of the helicopter when the rotor blades are turning.

(q) *Approaching helicopter.* Whenever approaching or leaving a helicopter with rotating blades, all employees shall remain in full view of the pilot and keep the head down. Employees shall avoid the area from the cockpit or cabin rearward unless authorized by the helicopter operator to work there.

(r) *Personnel.* Sufficient ground personnel shall be provided when required for safe helicopter loading and unloading operations.

(s) *Communications.* There shall be constant reliable communication between the pilot, and ground crew during the period of loading and unloading.

5. Part 1926 of Title 29, Code of Federal Regulations is proposed to be amended by adding thereto a new § 1926.556. Section 1926.556 would read as follows:

§ 1926.556 Aerial lifts.

(a) *General requirements.* All aerial lifts acquired for use after the effective date of this section shall be designed and constructed in conformance with the applicable requirements of the American National Standards Institute (ANSI) ANSI A92.2–1969, including appendix "Vehicle Mounted Elevating and Rotation Work Platforms." Aerial equipment acquired before the publication of this subpart which does not meet the requirements of ANSI A92.2–1969 may be retained in service until January 1, 1976. After January 1, 1976, if such equipment is retained in service it shall be modified to conform with ANSI A92.2–1969. An aerial lift is defined as one of the following types of vehicle-mounted aerial devices used to elevate personnel to jobsites above ground (1) extensible boom platforms (2) aerial ladders (3) articulating boom platforms (4) vertical towers (5) a combination of any of the above as defined in ANSI A92.2–1969. These devices are made of metal, wood, fiberglass reinforced plastic (FRP), or other material and are powered or manually operated; whether or not they are capable of rotating about a substantially vertical axis.

(b) *Specific requirements*—(1) *Ladder trucks and tower trucks.* Aerial ladders shall be secured in the lower traveling position by the locking device on top of truck cab, if so provided, and the manually operated device at the base of the ladder before the truck is moved for highway travel.

(2) *Extensible and articulating boom platforms.* (i) Lift controls shall be tested each day prior to use to determine that such controls are in safe working condition.

(ii) Only designated persons shall operate an aerial lift.

(iii) Belting off to an adjacent pole, structure, or equipment while working from an aerial lift shall not be permitted.

(iv) Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

(v) A safety belt shall be worn and a lanyard attached to the boom or lift when working from an aerial lift.

(vi) Boom and bucket load limits specified by the manufacturer shall not be exceeded.

(vii) The brakes shall be set and when outriggers are used, they shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline, providing they can be safely installed.

(viii) An aerial lift truck shall not be moved when the boom is elevated in working position with men in the basket, except for equipment which is specifically designed for this type of operation.

(ix) Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within each reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

(x) Equipment or material shall not be passed between a pole or structure and an aerial lift while an employee working from the basket is within reaching distance of energized conductors or equipment that are not covered with insulating protective equipment.

(xi) Climbers shall not be worn while performing work from an aerial lift.

(xii) The insulated portion of an aerial lift device shall not be altered with any material that might reduce its insulating value.

(xiii) Before moving an aerial lift truck, both the upper and lower boom shall be inspected to see that they are properly cradled and outriggers are in stowed position except as provided in subdivision (viii) of this subparagraph.

(xiv) When working near energized lines or equipment, aerial lift trucks shall be grounded or barricaded and considered as energized equipment, or the aerial lift truck shall be insulated for the work being performed.

6. A new subpart, designated Subpart V, would be added, dealing with power transmission and distribution, and would read as follows:

Subpart V—Power Transmission and Distribution

§ 1926.950 General requirements.

(a) *Application.* The occupational safety and health standards contained in this Subpart V shall apply to the construction of electric transmission and distribution lines and equipment.

(1) As used in this Subpart V the term "construction" means the erection of new electric transmission and distribution lines and equipment, or the alteration, conversion, or improvement of existing electric transmission and distribution lines and equipment.

(2) Existing electric transmission and distribution lines and electrical equipment need not be modified to conform to the requirements of applicable standards in this Subpart V, until such work as described in subparagraph (1) of this paragraph is to be performed on such lines or equipment.

(3) The standards set forth in this Subpart V provide the minimum requirements for safety and health. Employers may require adherence to additional standards which are not in conflict with the standards contained in this Subpart V.

(b) *Existing conditions.* (1) Before starting work, inspection or tests shall be made to determine existing conditions.

(2) Electric equipment and lines shall be considered energized unless tested and determined to be deenergized.

(3) Operating voltage of equipment and lines shall be determined before working on or near energized parts.

(c) *Clearances.* The provisions of subparagraph (1) or (2) of this paragraph shall be observed.

(1) No employee shall be permitted to approach or take any conductive object, without an approved insulating handle, closer to exposed energized parts than shown in Table V–1, unless;

(i) The employee is insulated or guarded from the energized part (gloves or gloves with sleeves rated for the voltage involved shall be considered insulation of the employee from the energized part), or

(ii) The energized part is insulated or guarded from him and any other conductive object at a different potential, or

(iii) The employee is isolated, insulated, or guarded from any other conductive object(s).

(2) (i) The minimum working distance and minimum clear hot stick distances stated in Table V–1 shall not be violated. Minimum clear hot stick distance refers to use of live-line tools held by linemen when performing live-line work.

(ii) Conductor support tools, such as link sticks, strain carriers, and insulator cradles, may be used provided that the clear insulation is at least as long as the insulator string.

TABLE V—1

ALTERNATING CURRENT—MINIMUM DISTANCES

Voltage range (phase to phase) kilovolt	*Minimum working and clear hot stick distance*
2.1 to 15	2 ft. 0 in.
15.1 to 35	2 ft. 4 in.
35.1 to 46	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121	3 ft. 4 in.
138 to 145	3 ft. 6 in.
161 to 169	3 ft. 8 in.
230 to 242	5 ft. 0 in.
345 to 362	[1] 7 ft. 0 in.
500 to 552	[1] 11 ft. 0 in.
700 to 765	[1] 15 ft. 0 in.

[1] NOTE: For 345 kv., 500 kv., and 700 kv., the minimum working distance and the minimum clear hot stick distance may be reduced provided that such distances are not less than the shortest distance between the energized part and a grounded surface.

(d) *Deenergizing lines and equipment.* (1) When deenergizing lines and equipment operated in excess of 600 volts, and the means of disconnecting from electric energy is not visible and open or locked out, the provisions of subdivisions (i) through (vii) of this subparagraph shall be complied with:

(i) The particular section of line or equipment to be deenergized shall be clearly identified, and it shall be isolated from all sources of voltage.

(ii) Notification and assurance from the designated employee shall be obtained that all switches and disconnectors through which electric energy may be supplied to the particular section of line or equipment to be worked has been deenergized, rendered inoperable, and plainly tagged, indicating that men are at work.

(iii) After all switches and disconnectors designated have been opened, rendered inoperable and tagged, visual inspection or tests shall be conducted to insure that equipment or lines have been deenergized.

(iv) Protective grounds shall be applied on the disconnected lines or equipment to be worked on.

(v) Guards or barriers shall be erected as necessary to adjacent energized lines.

(vi) When more than one independent crew requires the same line or equipment to be deenergized, a tag for each such independent crew shall be placed on the line or equipment.

(vii) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his crew have been removed, and he shall report to the designated employee that all tags protecting his crew may be removed.

(2) When the means of disconnecting from electric energy is visible and open or locked-out the provisions of subdivisions (i) and (ii) of this subparagraph shall apply.

(i) Guards or barriers shall be erected as necessary to adjacent energized lines.

(ii) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

(e) *Emergency procedures and first aid.* The employer shall provide training or require that his employees are knowledgeable and proficient in:

(1) Procedures involving emergency situations and

(2) First-aid fundamentals including resuscitation. (Alternatively, the employer may comply with the provisions of § 1926.50(b) regarding first-aid requirements.)

(f) *Night work.* When working at night, spotlights or portable lights for emergency lighting shall be provided as needed to safely perform the work.

(g) *Work over water.* When crews are engaged in work over or near water and where danger of drowning exists, suitable protection shall be provided as stated in § 1926.104, or § 1926.105, or § 1926.106.

(h) *Sanitation facilities.* The requirements of § 1926.51(c) of Subpart D shall be complied with for sanitation facilities.

(i) *Hydraulic fluids.* All hydraulic fluids used in derrick trucks, aerial lifts, and hydraulic tools which are used on or around energized lines and equipment shall be of the insulating type.

§ 1926.951 Tools and protective equipment.

(a) *Protective equipment.* (1) Rubber protective equipment shall be in accordance with the provisions of the American National Standards Institute (ANSI), ANSI J6 series, 1971. Protective equipment of other material shall provide equal or better electric and mechanical protection.

(2) Protective hats shall be in accordance with the provisions of ANSI Z89.2–1971 Industrial Protective Helmets For Electrical Workers, Class B, and shall be worn at all times at the jobsite by employees exposed to the hazards of falling objects, electric shock, or burns.

(b) *Personal climbing equipment.* (1) Safety belts and straps shall meet the requirements of § 1926.959. In addition to being used as an employee safeguarding item, safety belts with approved tool loops may be used for the purpose of holding tools. Body belts shall be free from additional metal hooks and tool loops.

(2) Safety belts with straps or lanyards shall be worn to protect employees working at elevated locations on poles, towers, or other structures except where such use creates a greater hazard to the safety of the employees.

(3) Safety belts and straps shall be inspected before use each day to determine that they are in safe working condition.

(4) Lifelines, safety and climbing ropes shall be a minimum half-inch diameter and three- or four-strand first-grade manila or its equivalent in strength (2,650 lb.) and durability.

(5) Defective ropes shall be replaced.

(c) *Ladders.* (1) Portable metal or conductive ladders shall not be used near energized lines or equipment except as may be necessary in specialized work such as in high voltage substations where nonconductive ladders might present a greater hazard than conductive ladders. Conductive or metal ladders shall be so marked and all necessary precautions shall be taken when used in specialized work.

(2) Hook or other type ladders used in structures shall be positively secured to prevent the ladder from being accidentally displaced.

(d) *Live-line tools.* (1) Only tools having a manufacturer's certification to withstand the following minimum tests shall be used:

(i) 100,000 volts per foot of length for 5 minutes when the tool is made of fiberglass; or

(ii) 75,000 volts per foot of length for 3 minutes when the tool is made of wood; or

(iii) Other tests equivalent to (i) or (ii) of this subparagraph as appropriate.

(2) All live-line tools shall be visually inspected before work each day. Defective tools shall be removed from service.

(e) *Measuring tapes or measuring ropes.* Measuring tapes or measuring ropes which are metal or contain conductive strands shall not be used when working on or near energized parts.

(f) *Handtools.* (1) Switches for all powered hand tools shall comply with § 1926.300(d).

(2) All portable electric handtools shall:

(i) Be equipped with three-wire cord having the ground wire permanently connected to the tool frame and means for grounding the other end; or

(ii) Be of the double insulated type and permanently labeled as "Doubled Insulated"; or

(iii) Be connected to the power supply by means of an isolating transformer, or other isolated power supply.

(3) All hydraulic tools which are used on or around energized lines or equipment shall use nonconducting hoses having adequate strength for the normal operating pressures. The provisions of § 1926.302(d)(2) of this part shall also apply.

(4) All pneumatic tools which are used on or around energized lines or equipment shall:

(i) Use nonconducting hoses having adequate strength for the normal operating pressures, and

(ii) Have an accumulator on the compressor to collect moisture.

§ 1926.952 Mechanical equipment.

(a) *General.* (1) Visual inspections shall be made of the equipment to determine that it is in good condition each day the equipment is to be used.

(2) Tests shall be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

(3) Utility vehicles shall be equipped with audible backup warning devices as provided in § 1926.601(b)(4).

(b) *Aerial lifts.* The provisions of § 1926.556, Subpart N, shall apply to the utilization of aerial lifts.

(c) *Derrick trucks, cranes and other lifting equipment.* (1) All derrick trucks, cranes and other lifting equipment shall comply with Subpart N and O of this part except:

(i) As stated in § 1926.550(a)(15) (i) and (ii) relating to clearances (for clearances in this subpart see Table V–1) and

(ii) Derrick trucks (electric line trucks) shall not be required to comply with § 1926.550(a) (3) and (17), but shall be equipped with boom angle indicators and load capacity plates.

(2) With the exception of equipment certified for work on the proper voltage, mechanical equipment shall not be operated in a manner where it is possible to bring such equipment or any part of the equipment closer to any high-voltage line or equipment than the clearances set forth in § 1926.950(c) unless:

(i) An insulated barrier is installed between the energized part and the mechanical equipment, or

(ii) The mechanical equipment is grounded and barricaded, or

(iii) The mechanical equipment is insulated, or

(iv) The mechanical equipment is considered as energized.

§ 1926.953 Material handling.

(a) *Unloading.* Prior to unloading steel, poles, cross arms and similar material, the load shall be thoroughly examined to ascertain if the load has shifted, binders or stakes have broken or the load is otherwise hazardous to workmen.

(b) *Pole hauling.* (1) During pole hauling operations, all loads shall be secured to prevent displacement and a red flag shall be displayed at the trailing end of the longest pole.

(2) Precautions shall be exercised to prevent blocking of roadways or endangering other traffic.

(3) When hauling poles during the hours of darkness, illuminated warning devices shall be attached to the trailing end of the longest pole.

(c) *Storage.* (1) No materials or equipment shall be stored under energized bus, energized lines, or near energized equipment, if it is practical to store them elsewhere. Extraordinary caution shall be exercised when moving materials near such energized equipment.

(2) Storage under energized lines or near energized equipment may be permitted: *Provided,* Applicable clearances are maintained as stated in Table V–1.

(d) *Tag line.* Where hazards to employees exist tag lines or other suitable devices shall be used to control loads being handled by hoisting equipment.

(e) *Oil filled equipment.* During construction or repair of oil filled equipment, the oil may be stored in temporary containers other than those required in § 1926.152, such as pillow tanks.

(f) *Framing.* During framing operations, employees shall not work under a pole or a structure suspended by a crane, A-frame or similar equipment unless the pole or structure is adequately supported.

§ 1926.954 Grounding for protection of employees.

(a) *General.* All conductors and equipment shall be treated as energized until tested, known to be deenergized or until grounded.

(b) *New construction.* New construction may be considered deenergized and worked as such where:

(1) Adequate clearance can be maintained from energized conductors to prevent contact, and

(2) The lines or equipment are grounded.

(c) *Communication conductors.* Open wire communication conductors on power poles or structures shall be treated as energized lines unless protected by insulating materials.

(d) *Voltage testing.* Deenergized conductors and equipment which are to be grounded shall be tested for voltage. Results of this voltage test shall determine the subsequent procedures as required in § 1926.950(d).

(e) *Attaching grounds.* (1) When attaching grounds, the ground end shall be attached first, and the other end shall be attached and removed by means of insulated tools or other suitable device.

(2) When removing grounds, the grounding device shall first be removed from the line or equipment using insulating handles or other suitable devices.

(f) *Location of grounds.* Grounds shall be placed between the work location and all sources of energy and as close as practicable to the work location. Where the making of a ground is impractical, or the conditions resulting therefrom would be more hazardous than working on the lines or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized.

(g) *Testing without grounds.* Grounds may be temporarily removed only when necessary for test purposes and extreme caution shall be exercised during the test procedures.

(h) *Grounding electrode.* When grounding electrodes are utilized, they shall have a resistance to ground low enough to minimize hazards to personnel or permit prompt operation of protective devices.

(i) *Grounding to tower.* Grounding to tower shall be made with a tower clamp capable of conducting the anticipated fault current.

(j) *Ground lead.* A ground lead, to be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and shall have a minimum conductance of No. 2 AWG copper.

§ 1926.955 Overhead lines.

(a) *Overhead lines.* (1) When working on or with overhead lines the provisions of subparagraphs (2) through (8) of this paragraph shall be com-

plied with in addition to other applicable provisions of this subpart.

(2) Prior to climbing poles, ladders, scaffolds, or other elevated structures, an inspection shall be made to determine that the structures are capable of sustaining the additional or unbalanced stresses to which they will be subjected.

(3) Where poles or structures may be unsafe for climbing, they shall not be climbed until made safe by guying, bracing, or other adequate means.

(4) Before installing or removing wire or cable, strains to which poles and structures will be subjected shall be considered and necessary action taken to prevent failure of supporting structures.

(5) (i) When setting, moving, or removing poles using cranes, derricks, gin poles, A-frames, or other mechanized equipment near energized lines or equipment, precautions shall be taken to avoid contact with energized lines or equipment, except in bare hand live line work, or where barriers or protective devices are used.

(ii) Equipment and machinery operating adjacent to energized lines or equipment shall comply with § 1926.952(c)(2).

(6) (i) Unless using suitable protective equipment for the voltage involved, employees standing on the ground shall avoid contacting equipment or machinery working adjacent to energized lines or equipment.

(ii) Lifting equipment shall be bonded to an effective ground or it shall be considered energized and therefore barricaded when utilized near energized equipment or lines.

(7) Pole holes shall not be left unattended or unguarded in areas where employees are currently working.

(8) Tag lines shall be of a nonconductive type when used near energized lines.

(b) *Metal tower construction.* (1) When working in unstable material the excavation for pad or pile-type footings in excess of 5 feet deep shall be either sloped to the angle of repose as required in § 1926.652 or shored if entry is required. Ladders shall be provided for access to pad or pile-type footing excavations in excess of 4 feet.

(2) When working in unstable material provision shall be made for cleaning out auger-type footings without requiring an employee to enter the footing unless shoring is used to protect the employee.

(3) (i) A designated employee shall be used in directing mobile equipment adjacent to footing excavations.

(ii) No one shall be permitted to remain in the footing while equipment is being spotted for placement.

(iii) Where necessary to assure the stability of mobile equipment, footing sites shall be graded and leveled.

(4) (i) Tower assembly shall be carried out with a minimum exposure from working at two levels on the tower.

(ii) Guy lines shall be used as necessary to maintain sections or parts of sections in position and to reduce the possibility of tipping.

(iii) Members and sections being assembled shall be adequately supported.

(5) When assembling and erecting towers the provisions of subdivisions (i), (ii), and (iii), of this subparagraph shall be complied with:

(i) The construction of transmission towers and the erecting of poles, hoisting machinery, site preparation machinery, and other types of construction machinery shall conform to the applicable requirements of this part.

(ii) No one shall be permitted under a tower which is in the process of erection or assembly except as required to guide and secure the section being set.

(iii) When erecting towers using hoisting equipment adjacent to energized transmission lines, the lines shall be deenergized when practicable. If the lines are not deenergized, extraordinary caution shall be exercised to maintain the minimum clearance distances required by § 1926.950(c), including Table V-1.

(6) (i) Erection cranes shall be set on firm level foundations and when the cranes are so equipped, outriggers shall be used.

(ii) Tag lines shall be utilized to maintain control of tower sections being raised and positioned, except where the use of such lines would create a greater hazard.

(iii) The loadline shall not be detached from a tower section until the section is adequately secured at each leg connection.

(iv) Erection shall be discontinued in the event of high wind or other adverse weather conditions which would make the work hazardous.

(v) Equipment and rigging shall be regularly inspected and maintained in safe operating condition.

(7) Adequate traffic control shall be maintained when crossing highways and railways with equipment as required by the provisions of § 1926.200(g) (1) and (2).

(8) A designated employee shall be utilized to determine that required clearance is maintained in moving equipment under or near energized lines.

(c) *Stringing or removing deenergized conductors.* (1) When stringing or removing deenergized conductors, the provisions of subparagraph (2) through (12) of this paragraph shall be complied with.

(2) Prior to stringing operations a briefing shall be held setting forth the plan of operation and specifying the type of equipment to be used, grounding devices and procedures to be followed, crossover methods to be employed, and the clearance authorization required.

(3) Where there is a possibility of the conductor accidentally contacting an energized circuit or receiving a dangerous induced voltage buildup, to further protect the employee from the hazards of the conductor, the conductor being installed or removed shall be grounded or provisions made to insulate or isolate the employee.

(4) (i) If the existing line is deenergized, proper clearance authorization shall be secured and the line grounded on both sides of the crossover or the line being strung or removed shall be considered and worked as energized.

(ii) When crossing over energized conductors in excess of 600 volts, rope nets or guard structures shall be installed unless provision is made to isolate or insulate the workman or the energized conductor. Where practicable the automatic reclosing feature of the circuit interrupting device shall be made inoperative. In addition, the line being strung shall be grounded on either side of the crossover or considered and worked as energized.

(5) Conductors being strung in or removed shall be kept under positive control by the use of adequate tension reels, guard structures, tielines, or other means to prevent accidental contact with energized circuits.

(6) Guard structure members shall be sound and of adequate dimension and strength, and adequately supported.

(7) (i) Catch-off anchors, rigging, and hoists shall be of ample capacity to prevent loss of the lines.

(ii) Stringing lines, pulling lines, sock connections, and all load-bearing hardware and accessories shall have a safety factor of at least three times the maximum pulling tension.

(iii) Pulling lines and accessories shall be inspected regularly and replaced or repaired when damaged or when dependability is doubtful. The provisions of § 1926.251(c)(4)(ii), splices, shall not apply.

(8) Conductor grips shall not be used on wire rope.

(9) While the conductor or pulling line is being pulled (in motion) employees shall not be permitted directly under overhead operations, nor shall any employee be permitted on the crossarm.

(10) A transmission clipping crew shall have a minimum of two structures clipped in between the crew and the conductor being sagged. When working on bare conductors, clipping and tying crews shall work between grounds at all times. The grounds shall remain intact until the conductors are clipped on dead end structures.

(11) (i) Except during emergency restoration procedures, work from structures shall be discontinued when adverse weather (such as high wind or ice on structures) makes the work hazardous.

(ii) Stringing and clipping operations shall be discontinued during the progress of an electrical storm in the immediate vicinity.

(12) (i) Reel handling equipment, including pulling and braking machines, shall have ample capacity, operate smoothly, and be leveled and aligned.

(ii) Reliable communications between the reel tender and pulling rig operator shall be provided.

(iii) Each pull shall be snubbed or dead ended at both ends before subsequent pulls.

(d) *Stringing adjacent to energized lines.* (1) Prior to stringing parallel to an existing energized transmission line a competent determination shall be made to ascertain whether dangerous induced voltage buildups will occur, particularly during switching and ground fault conditions. When there is a possibility that such dangerous induced volt-

age may exist the employer shall comply with the provisions of subparagraphs (2) through (9) of this paragraph in addition to the provisions of paragraph (c) of this § 1926.955, unless the line is worked as energized.

(2) When stringing adjacent to energized lines the tension stringing method or other methods which preclude unintentional contact between the lines being pulled and any employee shall be used.

(3) All pulling and tensioning equipment shall be isolated, insulated, or effectively grounded.

(4) A ground shall be installed between the tensioning reel setup and the first structure in order to ground each bare conductor, subconductor, and overhead ground conductor during stringing operations.

(5) During stringing operations, each bare conductor, subconductor, and overhead ground conductor shall be grounded at the first tower adjacent to both the tensioning and pulling setup and in increments so that no point is more than 2 miles from a ground.

(i) The grounds shall be left in place until conductor installation is completed.

(ii) Such grounds shall be removed as the last phase of aerial cleanup.

(iii) Except for moving type grounds, the grounds shall be placed and removed with a hot stick.

(6) Conductors, subconductors, and overhead ground conductors shall be grounded at all dead-end or catch-off points.

(7) A ground shall be located at each side and within 10 feet of working areas where conductors, subconductors, or overhead ground conductors are being spliced at ground level. The two ends to be spliced shall be bonded to each other. It is recommended that splicing be carried out on either an insulated platform or on a conductive metallic grounding mat bonded to both grounds. When a grounding mat is used, it is recommended that the grounding mat be roped off and an insulated walkway provided for access to the mat.

(8) (i) All conductors, subconductors, and overhead ground conductors shall be bonded to the tower at any isolated tower where it may be necessary to complete work on the transmission line.

(ii) Work on deadend towers shall require grounding on both sides of the tower.

(iii) Grounds may be removed as soon as the work is completed: *Provided*, That the line is not left open-circuited at the isolated tower at which work is being completed.

(9) When performing work from the structures, clipping crews and all others working on conductors, subconductors, or overhead ground conductors shall be protected by individual grounds installed at every work location.

(e) *Live-line bare-hand work.* In addition to the applicable standards contained elsewhere in this subpart all bare-hand live-line work shall be performed in accordance with the following requirements:

(1) Employees shall be instructed and trained in the live-line bare-hand technique and the safety requirements pertinent thereto before being permitted to use the technique on energized cricuits.

(2) Before using the live-line bare-hand technique on energized high-voltage conductors or parts, a check shall be made of:

(i) The voltage rating of the circuit on which the work is to be performed.

(ii) The clearances to ground of lines and other energized parts on which work is to be performed.

(iii) The voltage limitations of the aerial-lift equipment intended to be used.

(iv) Only equipment designed, tested, and intended for live-line bare-hand work shall be used.

(3) All work shall be personally supervised by a person trained and qualified to perform bare-hand live-line work.

(4) The automatic reclosing feature of circuit interrupting devices shall be made inoperative before working on any energized line or equipment.

(5) Work shall not be performed during the progress of an electrical storm in the immediate vicinity.

(6) A conductive bucket liner or other suitable conductive device shall be provided for bonding the insulated aerial device to the energized line or equipment.

(i) The employee shall be connected to the bucket liner by use of conductive shoes, leg clips, or other suitable means.

(ii) Adequate electrostatic shielding for the voltage being worked or conductive clothing shall be provided and used where necessary.

(7) Only tools and equipment intended for bare-hand live-line work shall be used, and such tools and equipment shall be kept clean and dry.

(8) Before the boom is elevated, the outriggers on the aerial truck shall be extended and adjusted to stabilize the truck, and the body of the truck shall be bonded to an effective ground, or barricaded and considered as energized equipment.

(9) Before moving the aerial lift into the work position, all controls (ground level and bucket) shall be checked and tested to determine that they are in proper working condition.

(10) Arm current tests shall be made before starting work each day, each time during the day when higher voltage is going to be worked and when changed conditions indicate a need for additional tests. Aerial buckets used for bare-hand live-line work shall be subjected to an arm current test. This test shall consist of placing the bucket in contact with an energized source equal to the voltage to be worked upon for a minimum time of three (3) minutes. The leakage current shall not exceed 1 microampere per kilovolt of nominal line-to-line voltage. Work operations shall be suspended immediately upon any indication of a malfunction in the equipment.

(11) All aerial lifts to be used for bare-hand live-line work shall have dual controls as required by sudivision (i) and (ii) of this subparagraph.

(i) The controls shall be located at the top end of the boom within easy reach of the employee. If a two basket type lift is used, access to the controls shall be within easy reach from either basket.

(ii) A duplicate set of controls shall be located near base of the boom that will permit over-ride operation of equipment at any time.

(12) Ground level lift control shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

(13) Before the employee contacts the energized part to be worked on, the conductive bucket liner shall be bonded to the energized conductor by means of a positive connection which shall remain attached to the energized conductor until the work on the energized circuit is completed.

(14) The minimum clearance distances for live-line bare-hand work shall be as specified in Table V–2. These minimum clearance distances shall be maintained from all grounded objects and from lines and equipment at a different potential than that to which the insulated aerial device is bonded unless such grounded objects or other lines and equipment are covered by insulated guards. These distances shall be maintained when approaching, leaving, and when bonded to the energized circuit.

TABLE V–2

MINIMUM CLEARANCE DISTANCES FOR LIVE-LINE BARE-HAND WORK (ALTERNATING CURRENT)

Voltage range (phase-to-phase) kilovolts	Distance in feet and inches for maximum voltage	
	Phase to ground	Phase to phase
2.1–15	2'0"	2'0"
15.1–35	2'4"	2'4"
35.1–46	2'6"	2'6"
46.1–72.5	3'0"	3'0"
72.6–121	3'4"	4'6"
138–145	3'6"	5'0"
161–169	3'8"	5'6"
230–242	5'0"	8'4"
345–362	[1] 7'0"	[1] 13'4"
500–552	[1] 11'0"	[1] 20'0"
700–765	[1] 15'0"	[1] 31'0"

[1] NOTE: For 345 kv., 500 kv., and 700 kv., the minimum clearance distance may be reduced provided they are not made less than the shortest distance between the energized part and a grounded surface.

(15) When approaching, leaving, or bonding to an energized circuit the minimum air-gap distances in Table V–2 shall be maintained between all parts of the insulated boom assembly and any grounded parts, including the lower arm or portions of the truck.

(16) When positioning the bucket along side an energizing bushing or insulator string, the minimum line-to-ground clearances of Table V–2 must be maintained between all parts of the bucket and the bushing or insulator string.

(17) (i) The use of hand lines between buckets, booms, and the ground is prohibited.

(ii) No conductive materials over 36 inches long shall be placed in the bucket(s), except for appropriate length jumpers, armor rods, and tools.

(iii) Nonconductive-type handlines may be used from line to ground when not supported from the bucket(s).

(18) The bucket(s) and upper insulated boom shall not be overstressed

by attempting to lift or support weights in excess of the manufacturer's rating.

(19) (i) A minimum clearance table (as shown in Table V–2) shall be printed on a plate of durable nonconductive material, and mounted in the buckets or its vicinity so as to be visible to the operator of the boom.

(ii) It is recommended that insulated measuring sticks be used to verify clearance distances.

§ 1926.956 Underground lines.

(a) *Grounding and ventilating manholes and street openings.* (1) Appropriate warning signs shall be promptly placed when covers of manholes, handholes or vaults are removed. What is an appropriate warning sign is dependent upon the nature and location of the hazards involved.

(2) When work is performed within a manhole or street opening, it shall be promptly protected with a barrier, temporary cover or other suitable guard.

(3) When working in manholes or unvented vaults:

(i) The atmosphere shall be tested for harmful gases and fumes. No entry shall be permitted unless the atmosphere is found to be safe.

(ii) Where unsafe conditions are detected, by testing or other means, the work area shall be ventilated and otherwise made safe before entry.

(iii) Provisions shall be made for an adequate continuous supply of air.

(b) *Work in manholes.* (1) While work is being performed in manholes, an additional employee shall be available in the immediate vicinity to render assistance as may be required, this requirement shall not preclude a qualified employee, working alone, from entering a manhole where energized cables or equipment are in service, for the purpose of inspection, housekeeping, taking readings, or similar work if such work can be performed safely.

(2) When open flames must be used or smoking is permitted in manholes, extra precautions shall be taken to provide adequate ventilation.

(3) Before using open flames in manholes, or excavations in areas where combustible gases or liquids may be present such as near gasoline service stations, the atmosphere of the manhole or excavation shall be tested and found safe or cleared of the combustible gases or liquids.

(c) *Trenching and excavating.* (1) During excavation or trenching in order to prevent the exposure of employees to the hazards created by damage to dangerous underground facilities efforts shall be made to determine the location of such facilities and work conducted in a manner designed to avoid damage.

(2) Trenching and excavation operations shall comply with §§ 1926.651 and 1926.652.

(3) When underground facilities are exposed (electric, gas, water, telephone, etc.) they shall be protected as necessary to avoid damage.

(4) Where multiple cables exist in an excavation, cables other than the one being worked on shall be protected as necessary.

(5) When multiple cables exist in an excavation, the cable to be worked on shall be identified by electrical means unless its identity is obvious by reason of distinctive appearance.

(6) Before cutting into a cable or opening a splice, the cable shall be identified and verified to be the proper cable.

(7) When working on buried cable or on cable in manholes, metallic sheath continuity shall be maintained by bonding across the opening or by equivalent means.

§ 1926.957 Construction in energized substations.

(a) *Work near energized equipment facilities.* (1) When construction work is performed in an energized substation, authorization shall be obtained from the designated, authorized person before work is started.

(2) When work is to be done in an energized substation, the following shall be determined:

(i) What facilities are energized, and

(ii) What protective equipment and precautions are necessary for the safety of personnel.

(3) Extraordinary caution shall be exercised in the handling of busbars, tower steel, materials, and equipment in the vicinity of energized facilities. The requirements set forth in § 1926.950(c), shall be complied with.

(b) *Deenergized equipment or lines.* When it is necessary to deenergize equipment or lines for protection of employees, the requirements of § 1926.950(d) shall be complied with.

(c) *Barricades and barriers.* (1) Barricades or barriers shall be installed to prevent accidental contact with energized lines or equipment.

(2) Where appropriate, signs indicating the hazard shall be posted near the barricade or barrier. These signs shall comply with § 1926.200.

(d) *Control panels.* (1) Work on or adjacent to energized control panels shall be performed by designated employees.

(2) Precaution shall be taken to prevent accidental operation of relays or other protective devices due to jarring, vibration, or improper wiring.

(e) *Mechanized equipment.* (1) Use of vehicles, gin poles, cranes, and other equipment in restricted or hazardous areas shall at all times be controlled by designated employees.

(2) All mobile cranes and derricks shall be effectively grounded when being moved or operated in close proximity to energized lines or equipment, or the equipment shall be considered energized.

(3) Fenders shall not be required for lowboys used for transporting large electrical equipment, transformers, or breakers.

(f) *Storage.* The storage requirements of § 1926.953(c) shall be complied with.

(g) *Substation fences.* (1) When a substation fence must be expanded or removed for construction purposes, a temporary fence affording similar protection when required, shall be provided. Adequate interconnection with ground shall be maintained between temporary fence and permanent fence.

(2) All substation gates shall be locked except when work is in progress or the substation is left unattended.

(h) *Footing excavation.* (1) Excavation for auger, pad and piling type footings for structures and towers shall require the same precautions as for metal tower construction (see § 1926.955(b)(1)).

(2) No employee shall be permitted to enter an unsupported auger-type excavation in unstable material for any purpose. Necessary clean-out in such cases shall be accomplished without entry.

§ 1926.958 External load helicopters.

In all operations performed using a Rotorcraft for moving or placing external loads, the provisions of § 1926.551 of Subpart N shall be complied with.

§ 1926.959 Requirements for safety belts and straps.

(a) *General requirements.* In addition to the specific requirements of this section the provisions of § 1926.104 (e) and (f) shall be complied with.

(b) *Specific requirements.* (1) (i) All fabric used for safety straps shall withstand an a.c. dielectric test of not less than 25,000 volts per foot "Dry" for 3 minutes, without visible deterioration.

(ii) All fabric and leather used shall be tested for leakage current and shall not exceed 1 milliampere when a potential of 3,000 volts is applied to the electrodes positioned 12 inches apart.

(iii) Direct current tests may be permitted in lieu of alternating current tests.

(2) The cushion part of the body belt shall: (i) Contain no exposed rivets on the inside;

(ii) Be at least three (3) inches in width;

(iii) Be at least five-thirty-seconds (5/32) inch thick, if made of leather; and

(iv) Have pocket tabs that extended at least 1½ inches down and three (3) inches inside of circle of each Dee ring for riveting on plier or tool pockets. On shifting "D" belts, this measurement for pocket tabs shall be taken when the Dee ring section is centered.

(3) A maximum of four (4) tool loops shall be so situated on the body belt that four (4) inches of the body belt in the center of the back, measuring from "Dee" ring to "Dee" ring, shall be free of loops.

(4) Suitable copper, steel, or equivalent liners shall be used around bar of "Dee" rings to prevent wear between these members and the leather or fabric enclosing them.

(5) All stitching shall be of nylon or equivalent thread and shall be lock stitched. Stitching parallel to an edge shall not be less than three-sixteenths (3/16) inch from edge of narrowest member caught by the thread. The use of cross stitching on leather is prohibited.

(6) The keeper of snap hooks shall have a spring tension that will not allow the keeper to begin to open with a weight of less than 2½ pounds. The keeper of snap hooks shall begin to open with a maximum of four (4) pounds when the

weight is supported on the keeper against the end of the nose.

§ 1926.960 Definitions for Subpart V.

(a) *Alive or live (energized).* The term means electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of the earth in the vicinity. The term "live" is sometimes used in place of the term "current-carrying," where the intent is clear, to avoid repetition of the longer term.

(b) *Automatic circuit recloser.* The term means a self-controlled device for automatically interrupting and reclosing an alternating current circuit, with a predetermined sequence of opening and reclosing followed by resetting, hold closed, or lockout operation.

(c) *Barrier.* The term means a physical obstruction which is intended to prevent contact with energized lines or equipment.

(d) *Barricade.* The term means a physical obstruction such as tapes, screens, or cones intended to warn and limit access to a hazardous area.

(e) *Bond.* The term means an electrical connection from one conductive element to another for the purpose of minimizing potential differences or providing suitable conductivity for fault current or for mitigation of leakage current and electrolytic action.

(f) *Bushing.* The term means an insulating structure including a through conductor, or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

(g) *Cable.* The term means a conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable) or a combination of conductors insulated from one another (multiple-conductor cable).

(h) *Cable sheath.* The term means a protective covering applied to cables. NOTE: A cable sheath may consist of multiple layers of which one or more is conductive.

(i) *Circuit.* The term means a conductor or system of conductors through which an electric current is intended to flow.

(j) *Communication lines.* The term means the conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. When operating at less than 150 volts no limit is placed on the capacity of the system. NOTE: Telephone, telegraph, railroad signal, data, clock, fire, police-alarm, community television antenna, and other systems conforming with the above are included. Lines used for signaling puposes, but not included under the above definition, are considered as supply lines of the same voltage and are to be so run.

(k) *Conductor.* The term means a material, usually in the form of a wire, cable, or bus bar suitable for carrying an electric current.

(l) *Conductor shielding.* The term means an envelope which encloses the conductor of a cable and provides an equipotential surface in contact with the cable insulation.

(m) *Current-carrying part.* The term means a conducting part intended to be connected in an electric circuit to a source of voltage. Noncurrent-carrying parts are those not intended to be so connected.

(n) *Dead (deenergized).* The term means free from any electrical connection to a source of potential difference and from electrical charges: Not having a potental difference from that of earth. NOTE: The term is used only with reference to current-carrying parts which are sometimes alive (energized).

(o) *Designated employee.* The term means a qualified person delegated to perform specific duties under the conditions existing.

(p) *Effectively grounded.* The term means intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the build-up of voltages which may result in undue hazard to connected equipment or to persons.

(q) *Electric-supply equipment (supply equipment).* The term means equipment which produces, modifies, regulates, controls, or safeguards a supply of electric energy.

(r) *Enclosed.* The term means surrounded by a case, cage or fence, which will protect the contained equipment and prevent accidental contact of a person with live parts.

(s) *Equipment.* This is a general term which includes fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, a supply or communications installation.

(t) *Exposed.* The term means not isolated or guarded.

(u) *Electric-supply lines.* The term means those conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts to ground are always supply lines within the meaning of the rules, and those of less than 400 volts to ground may be considered as supply lines, if so run and operated throughout.

(v) *Guarded.* The term means protected by personnel, covered, fenced, or enclosed by means of suitable casings, barrier rails, screens, mats, platforms, or other suitable devices in accordance with standard barricading techniques designed to prevent dangerous approach or contact by persons or objects. NOTE: Wires, which are insulated but not otherwise protected, are not considered as guarded.

(w) *Ground. (Reference).* The term means that conductive body, usually earth, to which an electric potential is referenced.

(x) *Ground (as a noun).* The term means a conductive connection whether intentional or accidental, by which an electric circuit or equipment is connected to reference ground.

(y) *Ground (as a verb).* The term means the connecting or establishment of a connection, whether by intention or accident, of an electric circuit or equipment to reference ground.

(z) *Grounding electrode (ground electrode).* The term grounding electrode means a conductor embedded in the earth, used for maintaining ground potential on conductors connected to it, and for dissipating into the earth current conducted to it.

(aa) *Grounding electrode resistance.* The term means that value of resistance low enough to permit prompt operation of protective devices to minimize hazards to personnel.

(bb) *Grounding electrode conductor (grounding conductor).* The term means a conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.

(cc) *Grounded conductor.* The term means a system or circuit conductor which is intentionally grounded.

(dd) *Grounded system.* The term means a system of conductors in which at least one conductor or point (usually the middle wire, or neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a current-limiting device (not a current-interrupting device).

(ee) *Hotline tools and ropes.* The term means those tools and ropes which are especially designed for work on energized high voltage lines and equipment. No aerial equipment shall be considered hotline.

(ff) *Insulated.* The term means separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current. NOTE: When any object is said to be insulated, it is understood to be insulated in suitable manner for the conditions to which it is subjected. Otherwise, it is within the purpose of this subpart, uninsulated. Insulating covering of conductors is one means of making the conductor insulated.

(gg) *Insulation (as applied to cable).* The term means that which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

(hh) *Insulation shielding.* The term means an envelope which encloses the insulation of a cable and provides an equipotential surface in contact with cable insulation.

(ii) *Isolated.* The term means an object that is not readily accessible to persons unless special means of access are used.

(jj) *Manhole.* The term means a subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment and/or cable.

(kk) *Pulling tension.* The term means the longitudinal force exerted on a cable during installation.

(ll) *Qualified person.* The term means a person who by reason of experience or training is familiar with the operation

to be performed and the hazards involved.

(mm) *Switch.* The term means a device for opening and closing or changing the connection of a circuit. In these rules, a switch is understood to be manually operable, unless otherwise stated.

(nn) *Tag.* The term means a system or method of identifying circuits, systems or equipment for the purpose of alerting persons that the circuit, system or equipment is being worked on.

(oo) *Unstable material.* The term means earth material, other than running, that because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

(pp) *Vault.* The term means an enclosure above or below ground which personnel may enter and is used for the purpose of installing, operating, and/or maintaining equipment and/or cable which need not be of submersible design.

(qq) *Voltage.* The term means the effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values. The nominal voltage of a system or circuit is the value assigned to a system for circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

(rr) *Voltage of an effectively grounded circuit.* The term means the voltage between any conductor and ground unless otherwise indicated.

(ss) *Voltage of a circuit not effectively grounded.* The term means the voltage between any two conductors. If one circuit is directly connected to and supplied from another circuit of higher voltage (as in the case of an autotransformer), both are considered as of the higher voltage, unless the circuit of lower voltage is effectively grounded, in which case its voltage is not determined by the circuit of higher voltage. Direct connection implies electric connection as distinguished from connection merely through electromagnetic or electrostatic induction.

Signed at Washington, D.C., this 3d day of May 1972.

(Sec. 107, 83 Stat. 96; 40 U.S.C. 333; sec. 6(b), 84 Stat. 1593; 29 U.S.C. 655)

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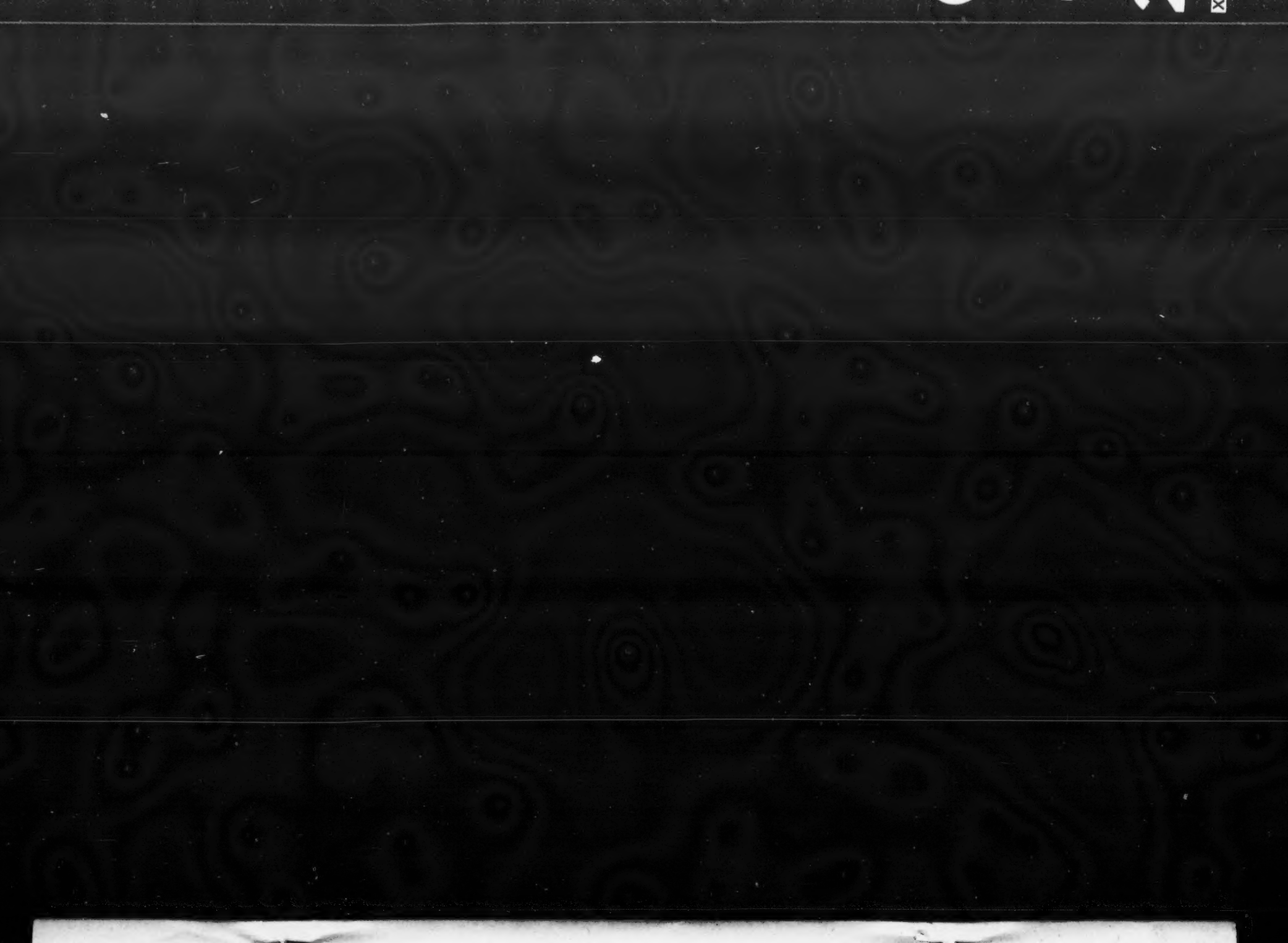
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